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Research Article

Namib Desert Asiloidea (Diptera) 1. A review of the assassin-fly genus *Acnephalomyia* Londt, 2010 (Asilidae) with the description of a new species

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Abstract

The genus *Acnephalomyia* Londt, 2010 (Diptera, Asilidae, Willistonininae) is reviewed in the southern Namib Desert. Currently, seven species of *Acnephalomyia* are recognised from Namibia and South Africa. In the southern Namib Desert, there are four *Acnephalomyia* species recorded to date: *Acnephalomyia andrenoides* (Wiedemann, 1828), *Acnephalomyia eremia* Londt, 2010, *Acnephalomyia iota* Londt, 2010 and *Acnephalomyia platygaster* (Loew, 1858). One new species, *Acnephalomyia metallicoindica* sp. nov. from the northern parts of the southern Namib Desert, is described and the single paratype of *Acnephalomyia iota* known from Namibia is assigned to this species, restricting *A. iota* to the Northern Cape Province of South Africa. *Acnephalomyia eremia* is recorded with several additional collecting events in the southern Namib Desert, extending its range significantly. Distribution, biology, occurrence in biodiversity hotspots *sensu* Conservation International and seasonal imago flight activity are discussed for each species. Diagnoses, photographs, specimen occurrence data and an identification key to species are provided with the new species described in detail. Online resources to the original descriptions or re-descriptions and an illustrated dichotomous identification key are provided and all specimen images are uploaded to a dedicated image repository. The southern Namib Desert is chiefly outlined by the Namib-Naukluft National Park and adjacent areas to the east using nature reserves and roads to delimit the study area more precisely. The knowledge of Diptera, Asiloidea species and important early collectors of specimens (including the museum depository), especially at the Gobabeb Namib Research Institute, is summarised. An updated key to the Asilidae genera of the Afrotropical Region, to include all species of *Acnephalomyia*, is provided. Both keys are made available online on the Lucid Keyserver.

Key words: Afrotropical, Namib Desert, robber fly

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Introduction

The Namib Desert is one of the oldest deserts on Earth, stretching along the Atlantic Ocean coast of southern Africa from south-westernmost Angola to southern Namibia for some 1,300 km at 100–150 km width. Earlier hypotheses proposed that the Namib may be up to 80 million years old (Seely 2010), but modern, more

robust estimates postulate an age of 34 million years with hyper-arid conditions prevailing for at least the past 22 million years (Lovegrove 2021, p. 36).

The taxonomic review presented here is the first in a series focusing on the asiloid fly fauna (Diptera, Asiloidea, chiefly Asilidae and Mydidae) of the Namib Desert and specifically in the Namib-Naukluft National Park (https://www.protectedplanet.net/883, https://national-parks.org/namibia/namib-naukluft) and adjacent areas. This National Park encompasses 49,768 km^2, making it the largest conservation area and National Park in Africa and the 4th largest in the world. Protection began in 1907 when the Namib Desert Park was founded (then as Game Reserve #3) and its current size was established later through the addition of the Naukluft Mountains in 1979, which had been a sanctuary for the Hartmann's Mountain Zebra (*Equus zebra hartmannae* (Matschie, 1898)).

The Namib-Naukluft NP is unique in southern Africa because it is dominated by desert habitats such as massive sand dunes, endless gravel plains and ephemeral rivers (Fig. 1A) that lay dry for years at a time, but groundwater is available and linear 'oases' are formed by a diversity of tree species (Seely 2010; Seely and Pallett 2012). The Namib Sand Sea World Heritage Site (https://whc.unesco.org/en/list/1430/), with its unique biodiversity (see https://www.inaturalist.org/places/namib-sand-sea-world-heritage-site-na), is entirely situated within this National Park (Fig. 1B).

This new series of studies on Namib Desert Asiloidea focuses on the fly fauna in the southern Namib Desert and chiefly on the Namib-Naukluft National Park and adjacent areas. This is an area that has historically been sampled quite well (Table 1) – for a remote desert location – and recent fieldwork by T. Dikow and A. Cabrero has drastically increased the number of specimens since 2012.

What we delimit as the southern Namib Desert – for this and subsequent taxonomic reviews on Asiloidea flies – is demarcated by (Fig. 2A):

- Swakopmund in the north-west with the southern section of Dorob NP and the northern border of Namib-Naukluft NP;
- northern and north-eastern border of Namib-Naukluft NP;
- road C14 from Kuiseb Pass (K) to Solitaire (So);
- road C19 from Solitaire to junction with C27 continued to Sesriem (Se);
- road C27 from Sesriem to Helmeringhausen (H);
- road C13 from Helmeringhausen to Aus (A, junction with B4);
- road B4 from Aus to Lüderitz.

Utilising the National Park boundaries and adjacent roads allows for a kind of 'precision' in delimiting the southern Namib Desert as treated here. It includes private nature reserves directly abutting the Namib-Naukluft NP, such as the NamibRand NR (https://www.namibrand.com, Fig. 1B) with the more mesic Vornamib Namib Grasslands *sensu* Strohbach et al. (2025) that are often termed Pro-Namib (Scott and Shaw 2017). The eastern boundaries of the Namib Desert are defined by the irregular topography and the Great Western Escarpment of the Khomas Hochland, the base of which is considered the eastern boundary of the Namib Desert. The Naukluft Mountains (part of the Namib-Naukluft NP, east of C19 between Solitaire (So) and Sesriem (SE), Fig. 1B) are excluded here because of the mountainous terrain not being Namib Desert. The southern boundary of the Namib Desert is less rugged and slightly more

readily delimited by the change to the winter rainfall environment primarily south of the Aus–Lüderitz road (B4, Fig. 1B, Lovegrove (1993), p. 24). South of this road the area is considered the Succulent Karoo with its unique fauna and flora – especially succulent plants – and is listed as a global biodiversity hotspot *sensu* Conservation International (Fig. 1A, Mittermeier et al. 1998; Myers et al. 2000; Mittermeier et al. 2005).

Insect and Diptera research in the southern Namib Desert

The Gobabeb Namib Research Institute (gobabeb.org, 23°33'41"S, 015°02'28"E, see location Figs 1, 2A) is a research station dedicated to the study of the Namib Desert and is located in the north-western part of the Namib-Naukluft National Park (Fig. 1B). It is uniquely situated between the ephemeral Kuiseb River, the Namib Sand Sea and the desert gravel plains. It has played an important role in research aspects on climatology, geomorphology, botany, geology, zoology and other fields of this part of the Namib Desert for more than 60 years (e.g. Seely (1990)).

Entomologists who have collected Asiloidea flies at Gobabeb (and other parts of the southern Namib Desert) are listed in Table 1 along with the depository where specimens can be located. Some of the earliest specimens collected at Gobabeb from the 1960s to 1972 do not have collector labels and may have been collected by staff from the Gobabeb Research Station.

Lindner (1972, 1973), Kelsey (1976), Holm and Scholtz (1980), Wharton (1982) and Prinsloo (1990) provided the first data on the Diptera, including Asiloidea and insect fauna of the Lower Kuiseb River near Gobabeb. Based on his own fieldwork at Gobabeb and Swakopmund in 1970 (see Table 1), Erwin Lindner (1973) described three Asilidae species from this part of the Namib, i.e. *Prytanomyia kochi* (Lindner, 1973) (Laphriinae, see Londt and Dikow (2017b), https://www.gbif.org/species/9530280), *Stichopogon engeli* Lindner, 1973

Table 1. Early collectors of Diptera at Gobabeb Namib Research Institute and the southern Namib Desert, based on studied Asilidae and Mydidae specimens to date.

name	year(s)	collecting month(s)	depository	location of depository
A.L. Moore	1963	Nov	USNM	Washington, D.C., USA
J. Potgieter	1967	Apr	NMSA	Pietermaritzburg, KwaZulu-Natal, South Africa
Erwin Lindner	1970	Feb	SMNS	Stuttgart, Germany
BMNH Southern Africa Expedition	1972	Jan	NHMUK	London, UK
Mike & Bonnie Irwin	1974	Feb	NMSA	
Leif Lyneborg	1974	Feb	ZMUC	Copenhagen, Denmark
A. Cunningham	1976	Oct, Dec	NMSA	
Ole Lomholdt	1978	Feb	ZMUC	
Bob Wharton	1978–1979	all year	NMSA, NMNW	Pietermaritzburg, KwaZulu-Natal, South Africa, Windhoek, Khomas, Namibia
Leon Praetorius	1979–1982	Oct, Feb, Apr, Jun	NMSA, NMNW	
National Collection Kuiseb Survey	1983	Feb, Mar	SANC	Roodeplaat, Pretoria, Gauteng, South Africa
Josh Henschel	1988	Apr	INHS	Urbana-Champaign, IL, USA

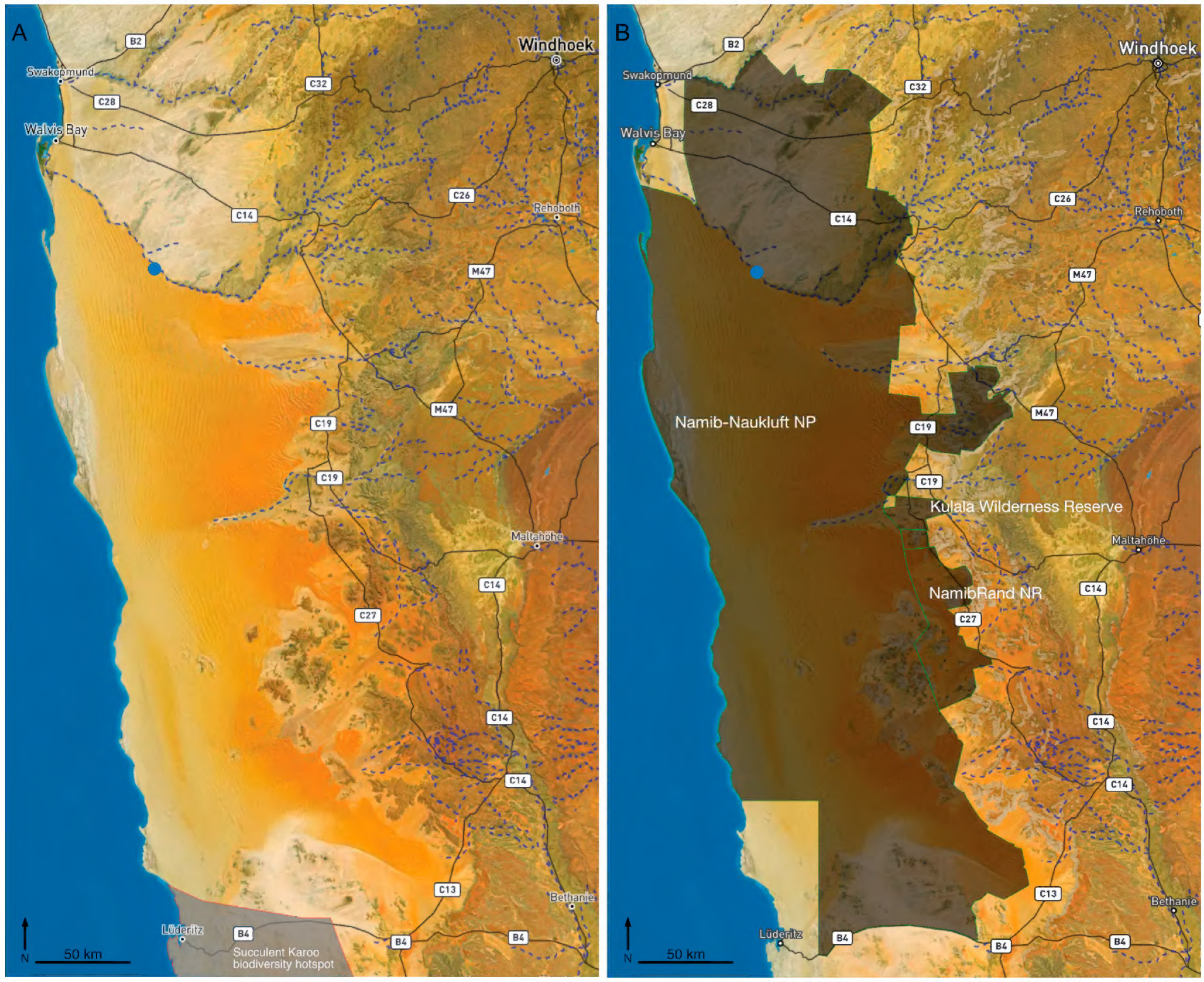

Figure 1. Maps of west-central Namibia with satellite imagery, major road network, major towns, watercourses (blue stippled to indicate non-permanent water flow) and biodiversity hotspots (*sensu* Conservation International in grey) introducing the southern Namib Desert as the study area. **A.** View of the Namib Sand Sea (light orange) between Swakopmund in the north and Lüderitz in the south. Note the grey area representing the northern reaches of the Succulent Karoo biodiversity hotspot; **B.** Selected protected areas (Namib-Naukluft NP, NamibRand NR, Kulala Wilderness Reserve) highlighted. Blue circle = Gobabeb Namib Research Institute.

(Stichopogoninae, see Londt (1979), https://www.gbif.org/species/1663764) and *Laphyctis orichalcea* (Lindner, 1973) (Laphriinae, see Londt and Dikow (2018), https://www.gbif.org/species/9780619). Lindner (1973) also recorded *Stichopogon punctus* Loew, 1851 (https://www.gbif.org/species/1663835) and *Laphyctis argenteofasciata* (Engel, 1929) and *Laphyctis gigantella* (Loew, 1852) (both now identified as *Laphyctis eremia* Londt & Dikow, 2018, https://www.gbif.org/species/9861347) from Gobabeb.

Kelsey (1976) described six species of Scenopinidae from the Namib Desert primarily collected by Mike Irwin in 1974 at Gobabeb (see Table 1), i.e. *Scenopinus namibensis* Kelsey, 1976 (https://www.gbif.org/species/1501642), *Propebrevitrichia canuta* Kelsey, 1976 (https://www.gbif.org/species/1502100), *Propebrevitrichia falcata* Kelsey, 1976 (https://www.gbif.org/species/1502080), *Propebrevitrichia gobabebensis* Kelsey, 1976 (https://www.gbif.org/species/1502093), *Propebrevitrichia irwini* Kelsey, 1976 (https://www.gbif.org/species/1502102)

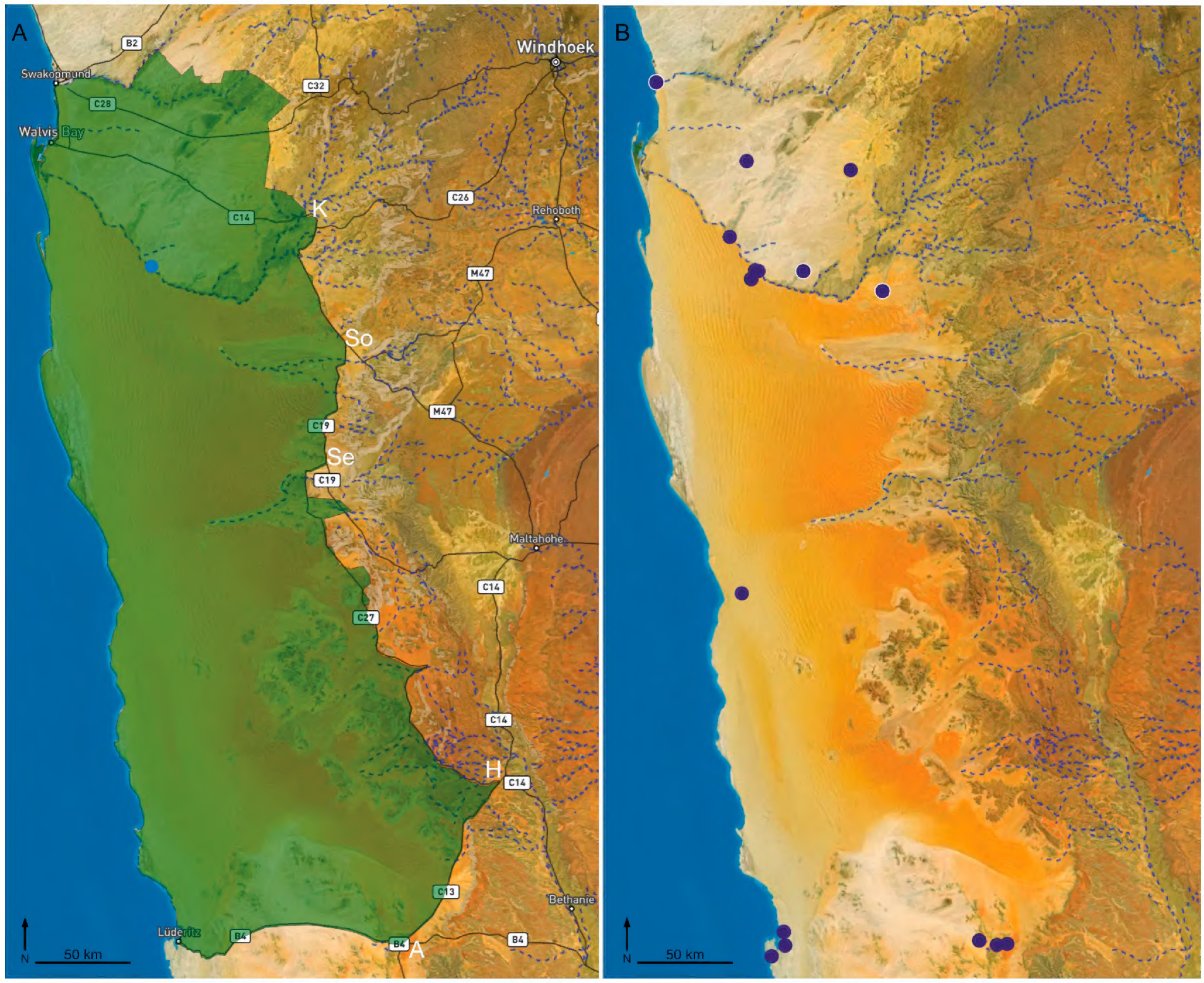

Figure 2. Maps of west-central Namibia with satellite imagery, major road network, major towns and watercourses (blue stippled to indicate non-permanent water flow). **A.** Study area southern Namib Desert highlighted in green (see text for details, blue circle = Gobabeb Namib Research Institute, K = Kuiseb Pass, So = Solitaire, Se = Sesriem, H = Helmeringhausen, A = Aus); **B.** Distribution of all *Acnephalomyia* specimens within the southern Namib Desert. White outline = type localities.

and *Propebrevitrichia swakopensis* Kelsey, 1976 (https://www.gbif.org/species/1502082). Five of these species occur in the southern Namib Desert. Kelsey (1976) also recorded *Scenopinus fenestralis* Linneaus, 1758 (https://www.gbif.org/species/1501621) from Gobabeb.

Holm and Scholtz (1980) recorded five species from four Diptera families including two unidentified species of *Neolophonotus* Engel, 1925 (Asilidae, Asilinae, https://www.gbif.org/species/1658544) from the Lower Kuiseb River at/near Gobabeb. Prinsloo (1990) recorded 50 species from 24 Diptera families including *Namadytes vansoni* Hesse, 1969 (Mydidae, see Dikow and Leon (2014), https://www.gbif.org/species/1591304). Wharton (1982) studied the Mydidae diversity and seasonal imago flight activity at Gobabeb over one year in 1978–1979.

Lyneborg (1987) recorded a new Therevidae genus and species, *Stenogephyra torrida* Lyneborg, 1987 (https://www.gbif.org/species/1566286) described from the Northern Cape Province of South Africa, also from Gobabeb and Swakopmund. A year later, Lyneborg (1988) reviewed the Therevidae genus *Orthactia* Kröber, 1912 (https://www.gbif.org/species/1565893) and described

two species from the Namib Desert, i.e. *Orthactia gobabebensis* Lyneborg, 1988 (https://www.gbif.org/species/1565900) and *Orthactia deserticola* Lyneborg, 1988 (https://www.gbif.org/species/1565899). Later, Irwin (2001) studied the Therevidae at Gobabeb through a year-long Malaise trap sampling and recorded four species, i.e. *Stenogephyra torrida*, *Phycus niger* Kröber, 1929 (https://www.gbif.org/species/5076194), *Rueppellia basalis* (Loew, 1858) (https://www.gbif.org/species/11149034) and *Orthactia gobabebensis*.

Lindner (1972) described the Bombyliidae species *Pteraulacodes hessei* Lindner, 1972 (https://www.gbif.org/species/1665506) from the *Welwitschia* Plains east of Swakopmund (approx. 22°42'46"S, 14°50'12"E) in the northern-most part of the Namib-Naukluft NP. He also recorded *Geron nomadicus* Hesse, 1938 (https://www.gbif.org/species/5094130) from Gobabeb and *Anthrax kaokoensis* Hesse, 1956 (https://www.gbif.org/species/1667127) and *Exoprosopa heros* (Wiedemann, 1819) (https://www.gbif.org/species/1672200) from Swakopmund. Greathead (2000) described the species *Heteralonia mira* Greathead, 2000 (https://www.gbif.org/species/1666393) from Gobabeb and recorded five additional species, i.e. *Geron gariepinus* Hesse, 1938 (https://www.gbif.org/species/5094009), *Geron nomadicus* Hesse, 1938 (https://www.gbif.org/species/5094130), *Anthrax doliops* Hesse, 1956 (https://www.gbif.org/species/1667292) and *Villa lasia* (Wiedemann, 1824) (https://www.gbif.org/species/1671586), from the same place. Evenhuis (2000) described the micro bee fly (Mythicomyiidae) *Doliopteryx welwitschia* Evenhuis, 2000 (https://www.gbif.org/species/1567326) from near Gobabeb (*Welwitschia* wash, approx. 23°38'00"S, 015°10'00"E). The same author described *Doliopteryx dichroma* Evenhuis, 2000 (https://www.gbif.org/species/1567328) and *Doliopteryx ecphata* Evenhuis, 2000 (https://www.gbif.org/species/1567320) from the Brandberg Massif and recorded the species also from Gobabeb (Evenhuis 2000). Later, Greathead (2006) recorded the bee fly species *Anastoechus leucosoma* Bezzi, 1921 (https://www.gbif.org/species/1665847), *Crocidium microstictum* Hesse, 1963 (https://www.gbif.org/species/5093005), and two morphospecies of *Apatomyza* Wiedemann, 1820 (https://www.gbif.org/species/1668400) from Gobabeb.

More recently, T. Dikow and A. Cabrero have conducted extensive field-work at Gobabeb and five additional field sites in the southern Namib Desert since 2012. The collected material, together with material from the collectors listed above, resulted in the discovery and description of seven new species to date, i.e. *Namibimydas psamminos* Dikow, 2012 (https://www.gbif.org/species/7952600) and *Namibimydas stuckenbergi* Dikow, 2012 (https://www.gbif.org/species/8056861) (Mydidae, Dikow 2012), *Anasillomos juergeni* Dikow, 2015 (Asilidae, Dikow 2015, https://www.gbif.org/species/8934816), *Laphyctis eremia* Londt & Dikow, 2018 (Asilidae, Londt and Dikow 2018), *Microphontes gaiophanes* Markee & Dikow, 2018 (Asilidae, Markee and Dikow 2018, https://www.gbif.org/species/10182921) and *Eremohaplomydas gobabebensis* Boschert & Dikow, 2022 (https://www.gbif.org/species/11672021) and *Eremohaplomydas whartoni* Boschert & Dikow, 2022 (Mydidae, Boschert and Dikow 2022, https://www.gbif.org/species/11547845). Several other species of Asilidae and Mydidae have been identified that are awaiting description in this series of manuscripts and other taxonomic revisions. Dikow (2024a, b) summarised the known Asilidae and Mydidae specimens from the immediate surroundings of the Gobabeb Namib Research Institute as a dataset at GBIF (https://www.

gbif.org) sourced from several collections and the recent fieldwork. An iNaturalist project has also been established to summarise the Diptera diversity at Gobabeb (https://www.inaturalist.org/projects/diptera-of-gobabeb).

Acnephalomyia in the southern Namib Desert

Acnephalomyia Londt, 2010 (Fig. 3) is a small genus of Asilidae, Willistonininae, Sisyrnodytini with currently seven valid species distributed primarily in western and southern South Africa and southern Namibia (Londt 2010). Four species have been recorded from Namibia: the abundantly collected and widespread species *Acnephalomyia andrenoides* (Wiedemann, 1828) (Figs 3A, 5), the rare, endemic species *Acnephalomyia eremia* Londt, 2010 (Figs 3B–D, 6), the rare, widespread species *Acnephalomyia iota* Londt, 2010 and the widespread species *Acnephalomyia platygaster* (Loew, 1858) (Figs 9, 10). All four species are currently known to occur in the southern Namib Desert as well.

This study was instigated by the discovery and collection of small, unique flies belonging to *Acnephalomyia* in the Namib Desert in central Namibia by T. Dikow and A. Cabrero that did not key out immediately to one of the known seven species in the identification key published by Londt (2010). The project was part of an undergraduate summer research project at the USNM by the 1st author conducted in 2024.

The taxonomic history of *Acnephalomyia* within the southern Namib Desert can be summarised as follows (for more details on the genus, see Londt (2010)):

Loew (1858) described *Acnephalum platygaster* Loew, 1858 from Swakopmund, based on a unique male specimen collected by J.A. Wahlberg at 'Swakop' in 1854 (Fig. 9).

Londt (2010) described the genus *Acnephalomyia* with its type species *Dasypogon andrenoides* Wiedemann, 1828 to move all Afrotropical species of the Palaearctic genus *Acnephalum* Macquart, 1838. He described *Acnephalomyia eremia* based on a single specimen from the Namib Desert and *Acnephalomyia iota* based on three specimens (one from the Namib Desert). He recorded *Acnephalomyia andrenoides* and *Acnephalomyia platygaster* from the southern-most parts of the study area.

Londt and Dikow (2016) reviewed the Willistonininae genus *Trichoura* Londt, 1994 and provided an updated key to the world Willistonininae, including *Acnephalomyia*. Together with five other genera, *Acnephalomyia* is grouped in a newly-established tribe Sisyrnodytini.

Londt and Dikow (2017a) provided a review of the Afrotropical Asilidae with an updated key to the genera including *Acnephalomyia* and summarised what was known about this genus.

At the commencement of this study, *Acnephalomyia* in the southern Namib Desert (Fig. 2B) was, therefore, known from four species: *Acnephalomyia andrenoides* from the southernmost part near Aus and Lüderitz, *Acnephalomyia eremia* described from an isolated dune site on the eastern margin of the desert, *Acnephalomyia iota* described from the Northern Cape Province in South Africa with a single female from Vogelfederberg (50 km E Walvis Bay) and *Acnephalomyia platygaster* described from Swakopmund and recorded from the southernmost part near Aus. Habitats at which *Acnephalomyia* species were collected within the southern Namib Desert are summarised in Fig. 4.

Materials and methods

Morphological features were examined using Zeiss SteREO Discovery.V8 and V12 stereomicroscopes. Wing length is measured from the tegula to the distal tip of the wing. The analysis of specimen occurrence data and seasonal imago flight activity (Tables 2, 3) was conducted using the Python tool SpOccSum (Trizna and Dikow 2019).

Table 2. Collecting event summary for *Acnephalomyia* species in the southern Namib Desert.

species	# specimens	#♀/#♂	# collecting events	earliest collection	most recent collection	most recent iNaturalist observation
A. andrenoides	25	13/12	5	1983	2005	-
A. eremia	25	17/8	9	1971	2024	2017
A. platygaster	2	1/1	2	1854	1983	-
A. metallicoindica sp. nov.	8	7/1	3	1986	2024	-
Summary total	60	38/22	19	1854	2024	2017

Table 3. Seasonal imago flight activity of *Acnephalomyia* species in the southern Namib Desert through number of specimens collected and unique collecting events in each month (data given as # specimens/# collecting events). Months abbreviated starting with July. * = additional iNaturalist observation.

species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
A. andrenoides	-	23/4	2/1	-	-	-	-	-	-	-	-	-
A. eremia	-	1/1	22/6*	2/2	-	-	-	-	-	-	-	-
A. platygaster	-	1/1	-	-	-	-	-	-	-	-	-	-
A. metallicoindica sp. nov.	-	-	6/1	1/1	1/1	-	-	-	-	-	-	-
total	-	25/6	30/7	3/3	1/1	-	-	-	-	-	-	-

Terminology

Terminology follows Dikow (2009), Cumming and Wood (2017) and Londt and Dikow (2017a, general morphology and abbreviations for setae), Stuckenberg (1999, antennae) and Wootton and Ennos (1989, wing venation). Abdominal tergites are abbreviated in the descriptions with 'T' and sternites are abbreviated with 'S'. The terms prothoracic, mesothoracic and metathoracic are abbreviated 'pro', 'mes' and 'met', respectively. The term pubescence (adjective pubescent) refers to the short, fine microtrichia densely covering certain body parts. Other generalised terms follow the Torre-Bueno Glossary of Entomology (Nichols 1989).

Species description

The species description is based on composites of all specimens and not exclusively on the holotype and is compiled from a character matrix of 256 features assembled with Lucid Builder (version 4.0+) and eventually exported as natural-language description. This species description has been deposited in the Zenodo data depository and can be accessed in XML-format following the SDD (Structure of Descriptive Data) standard. All taxon names have been registered in ZooBank (Pyle and Michel 2008). If available, permanent URLs or Digital Object Identifiers (DOIs) to the original species descriptions on the Biodiversity Her-

itage Library (BHL, www.biodiversitylibrary.org) or Plazi TreatmentBank (https://plazi.org/treatmentbank/) are provided. The species record for each species at the Global Biodiversity Information Facility (GBIF, https://www.gbif.org) provides a summary of occurrence data and images from natural history collections or iNaturalist and taxonomic treatments from the published literature.

Specimen occurrence data

The specimen occurrences data including geographic coordinates are given along with a unique specimen identifier that will allow the re-investigation as well as provide a unique Life Science Identifier (LSID). The occurrence of all species is illustrated in distribution maps plotted with Mapbox Studio with all localities with co-ordinates approximated from online gazetteers or Google Earth. Square brackets [] encapsulating geographic co-ordinates denote enhanced accuracy not included on original labels. The distribution map in Fig. 1A includes Biodiversity Hotspots *sensu* Conservation International (Mittermeier et al. 1998; Myers et al. 2000; Mittermeier et al. 2005) with the latest shapefiles published by Noss et al. (2015) (deposited at Zenodo https://doi.org/10.5281/zenodo.3261807). The specimen occurrence data are deposited as a Darwin Core Archive (DwC-A) at GBIF using the Integrated Publishing Toolkit (IPT) at the NMNH.

Photographs

Whole habitus photographs of pinned specimens were taken with a GIGAmacro Magnify^2 system, a Canon EOS D5 Mark IV full-frame DSLR, a Canon MP-E 65 mm f2.8 macro-lens and illuminated by a Canon MR-14EX II Macro Ring Lite. Photographs of the female and male terminalia were taken on a Zeiss SteREO Discovery.V12 stereomicroscope with a PlanApo S 1.0x lens at 100x magnification and an attached Olympus OM-D E-M1 MicroFourThirds digital camera. The dissected terminalia were placed in 75% ethanol in a glass dish and illuminated by a Schott VisiLED light source utilising mixed bright-field (dorsal), dark-field (lateral) and transillumination (ventral). The MicroFourThirds camera was tethered to a laptop and controlled by Olympus Capture software and the vertical movement for obtaining photographs for later image stacking was done manually using the fine drive. Individual RAW-format images were stacked using HeliconFocus Pro (version 8.+) and exported in Adobe DNG-format. Photographs of Smithsonian USNM specimens are in the public domain with a Creative Commons license CC0 and can be downloaded in full resolution from the USNM data portal (https://collections.nmnh.si.edu/search/ento/) or the Smithsonian Open Access Portal (https://www.si.edu/openaccess). All photographs have been deposited in full-resolution in tif-format at FigShare and the specimen photo DOIs are included in the figure captions for access and downloading.

Keys

The online, interactive dichotomous pathway identification key has been built with Lucid Builder (version 4.0+) and can be accessed on Lucidcentral web-site and the asiloidflies.info web-site. It has also been archived in the Structure of Descriptive Data (SDD) standard at Zenodo.

Institutions providing specimens

Institutions providing specimens are listed below, together with the abbreviations used in the text when citing depositories (institutionCode), a link to the record in the Global Registry of Scientific Collections (GRSciColl) and the people who kindly assisted: **AMGS** – Albany Museum, Makhanda, Eastern Cape, South Africa (T. Bellingan); **NHRS** – Swedish Museum of Natural History, Stockholm, Sweden (G. Lindberg); **NMSA** – KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, South Africa (K. Williams); **NMNW** – National Museum of Namibia, Windhoek, Namibia (F. Becker); **SANC** – South African National Collection of Insects, Pretoria, Gauteng, South Africa (G. Theron); **USNM** – United States National Museum, Smithsonian Institution, Washington, D.C., USA.

Data resources

GBIF: specimen occurrence data-set – DOI https://doi.org/10.15468/2bbawn.

Lucid Builder: *Acnephalomyia* in the southern Namib Desert illustrated, dichotomous, pathway identification key – https://keys.lucidcentral.org/keys/v4/acnephalomyia_namib_dichotomous/ (archived in SDD format at Zenodo – DOI https://doi.org/10.5281/zenodo.14984435).

Lucid Builder: Afrotropical Asilidae genera illustrated, dichotomous, pathway identification key – https://keys.lucidcentral.org/keys/v4/afrotropical-asilidae-dichotomous (archived in SDD format at Zenodo – DOI https://doi.org/10.5281/zenodo.14984184).

Zenodo: natural-language species description from Lucid Builder in SDD format – DOI https://doi.org/10.5281/zenodo.17309255.

FigShare: full-resolution specimen photographs – DOI https://doi.org/10.25573/data.c.8038318.

ZooBank new nomenclatorial acts: https://zoobank.org/E1816FD5-584F-429C-AE13-CD0BCF699B5C.

Taxonomy

Acnephalomyia Londt, 2010

Acnephalomyia Londt, 2010: 438. Type-species: *Dasypogon andrenoides* Wiedemann, 1828, by original designation.

Links. ZooBank https://zoobank.org/03F3BD7D-4AE2-4E9B-968E-00B35E635075.
GBIF https://www.gbif.org/species/8748144
Plazi TreatmentBank https://treatment.plazi.org/id/FA455017-FFE3-AD73-FE05-760F4E09FEC4.
iNaturalist https://www.inaturalist.org/taxa/1125677-Acnephalomyia.

Diagnosis. The genus can be delineated by the greatly reduced, but still discernible pulvilli, the presence of an empodium, open cells r_1, r_5 and m_3, vein C terminating at point where CuA+CuP reach wing margin, the abdomen (somewhat to obviously) dorso-ventrally flattened with female and male terminalia retracted and not easily visible, females with acanthophorite spines and a humpbacked appearance of the majority of species.

Distribution, biodiversity hotspots, endemism, seasonal imago flight activity and biology. Known from the western parts of southern Africa in Namibia and South Africa (see Londt (2010): fig. 64). A relatively commonly observed and collected genus with 27 observations at iNaturalist (Table 2). Species of *Acnephalomyia* are known to occur in the Cape Floristic Region, Succulent Karoo and Maputaland-Pondoland-Albany biodiversity hotspots (see Londt (2010): fig. 64), but also occur outside of these hotspots. The genus is not endemic to a particular hotspot, environment or country. Adult flies are active from winter (July) to summer (February) (see Londt (2010), Table 3). Very little is known of the biology. Prey records cited by Londt (2010) include Coleoptera, Diptera, Heteroptera, Isoptera and Orthoptera.

Within the southern Namib Desert, species of *Acnephalomyia* are somewhat rarely collected from either the northern or southern parts (Figs 2B, 11). Four species are known to occur in the southern Namib Desert, of which two are endemic. Adult flies are active in late winter (August) and throughout spring (September–October) with one record in November (Table 3).

Remarks. Londt (2010) described *Acnephalomyia iota* and mentioned: "A tiny black species not to be confused with any other [species]". Identification of this small species to the genus *Acnephalomyia* is not straightforward given the most recent key in Londt and Dikow (2017a) as the stump vein R_3 (supernumerary cross-vein) at the base of R_4 is not present, which is a feature that the majority of Afrotropical Willistonininae genera with reduced pulvilli possess, i.e. *Acnephalomyia*, *Sisyrnodytes* Loew, 1856 and *Sporadothrix* Hermann, 1908 and which is absent in *Ammodaimon* Londt, 1985 and *Astiptomyia* Londt, 2010 (Londt and Dikow 2016). The same is true for *A. metallicoindica* sp. nov., which initially was not recognised and identified by the authors as belonging to *Acnephalomyia*. In part, also because the abdomen is not 'obviously dorso-ventrally flattened' and expanded laterally as in other, more 'regular' *Acnephalomyia* species (a character used by Londt (2010) and Londt and Dikow (2017a)). Therefore, an updated identification key to the genera of Afrotropical Asilidae (Londt and Dikow 2017a) has been developed and is available electronically with photographs and links to further resources at keys.lucidcentral.org/keys/v4/afrotropical-asilidae-dichotomous. A new set of couplets 34–37 of the Londt and Dikow (2017a) key that help identify the Willistonininae genera with reduced pulvilli is provided below.

Updated key to genera of Afrotropical Willistonininae with reduced pulvilli

(see Londt and Dikow (2017a), couplets 34–37)

34 Empodium absent; dorsocentral macrosetae well-developed, many times longer than scutal setae; anepisternum without any erect macroseta postero-medially; small flies (wing length < 3.5 mm) ..... ***Ammodaimon***

– Empodium present; dorsocentral macrosetae may be present, but never many times longer than other scutal setae; anepisternum with 1–4 long erect macrosetae postero-medially; usually distinctly larger flies (wing length usually > 4.5 mm).....**35**

35 Proximal element of antennal stylus 1/2 length of distal element (plus apical seta-like sensory element); abdomen cylindrical with female and male terminalia clearly visible and prominent apically ('exposed'); R_3 developed as short stump vein (supernumerary cross-vein) at base of R_4 ..... ***Sporadothrix***

– Proximal element of antennal stylus at most 1/5 length of distal element (plus apical seta-like sensory element); abdominal tergites appear broader than long with female and male terminalia retracted under the abdominal tergites and not easily visible; R_3 (short stump vein, supernumerary cross-vein) either absent or present at base of R_4 .....**36**

36 Vein C terminating before reaching CuA+CuP; cell r_5 closed and petiolate (petiole frequently failing to reach wing margin) ..... ***Sisyrnodytes***

– Vein C terminating at point where CuA+CuP reaches wing margin; cell r_5 open.....**37**

37 Cell m_3 open; pulvilli greatly reduced, but clearly discernible ...***Acnephalomyia***

– Cell m_3 closed and petiolate; pulvilli minute (difficult to detect) or absent . .....***Astiptomyia***

***Acnephalomyia andrenoides* (Wiedemann, 1828)**
Figs 3A, 5, 11A

Links. ZooBank https://zoobank.org/7795FAC0-E920-4241-B4B6-2BEE31EF670E. GBIF https://www.gbif.org/species/10799358.
original description online https://www.biodiversitylibrary.org/page/14504888.
Plazi TreatmentBank https://treatment.plazi.org/id/FA455017-FFEC-AD6A-FECA-741A495BFCD2.

Type locality. South Africa: Capland (south-western South Africa).

Material examined. Type material: not studied (lectotype deposited in Museum für Naturkunde (MFN), Berlin, Germany).

Other material. Namibia – Karas • 5♂ Agate Beach, 8 km N Lüderitz; [26°36'22"S, 015°10'42"E]; 31 Aug 1983; Stuckenberg, Brian, Londt, Jason leg.; arid vegetated dunes, NMSA-DIP 007181, NMSA-DIP 108624, NMSA-DIP 108625, NMSA-DIP 108626, NMSA-DIP 108628; NMSA • 3♀Agate Beach, 8 km N Lüderitz; [26°36'22"S, 015°10'42"E]; 31 Aug 1983; Stuckenberg, Brian, Londt, Jason leg.; arid vegetated dunes, NMSA-DIP 108627, NMSA-DIP 108628, NMSA-DIP 108629; NMSA • 4♂ Lüderitz, 3 km E, Golf Club; [26°40'06"S, 015°11'04"E]; 31 Aug 1983; Stuckenberg, Brian, Londt, Jason leg.; arid rocky slopes, NMSA-DIP 007183, NMSA-DIP 108642, NMSA-DIP 108643, NMSA-DIP 108644; NMSA • 6♀ Lüderitz, 3 km E, Golf Club; [26°40'06"S, 015°11'04"E]; 31 Aug 1983; Stuckenberg, Brian, Londt, Jason leg.; arid rocky slopes, NMSA-DIP 108645, NMSA-DIP 108646, NMSA-DIP 108647, NMSA-DIP 108648, NMSA-DIP 108649, NMSA-DIP 108650; NMSA • 1♂ Lüderitz, Grosse Bucht; [26°43'00"S, 015°07'00"E]; 07 Sep 2005; Gess, F., Gess, S. leg.; on ground, AMGS-102149; AMGS • 1♀ Lüderitz, Grosse Bucht; [26°43'00"S, 015°07'00"E]; 07 Sep 2005; Gess, F., Gess, S. leg.; on ground, AMGS-102150; AMGS • 3♀ Aus, 10 km W; [26°38'44"S, 016°10'13"E]; 30 Aug 1983; Londt, Jason, Stuckenberg, Brian leg.; sparse grassveld, small woody plants, NMSA-DIP 007193, NMSA-DIP 108633, NMSA-DIP 108634; NMSA • 2♂ Aus, 10 km W; [26°38'44"S, 016°10'13"E]; 30 Aug 1983; Londt,

Figure 3. Photographs of *Acnephalomyia* species in nature. **A.** *Acnephalomyia andrenoides* female perching at Rocherpan NR, Western Cape, South Africa, 20 Sep 2017 (32°37'01"S, 018°17'53"E); **B–D.** *A. eremia* on small dune with dry !nara plant (Cucurbitaceae, *Acanthosicyos horridus*), Gobabeb, Namib-Naukluft NP, Erongo, Namibia, 27 Sep 2017 (23°33'52"S, 015°02'07"E); **B.** Male perching; **C.** Female perching; **D.** Female ovipositing. Photographs by T. Dikow.

Jason, Stuckenberg, Brian leg.; sparse grassveld, small woody plants, NMSA-DIP 108631, NMSA-DIP 108632; NMSA • 1♂ Aus, 5 km E; [26°39'39"S, 016°18'46"E]; 30 Aug 1983; Londt, Jason, Stuckenberg, Brian leg.; open veld with low green grass and shrubs, NMSA-DIP 007072; NMSA.

Diagnosis. The species is distinguished from congeners by the yellowish to light brown setose scutum, the entirely asetose katepisternum, the presence of dorso-ventrally flattened setae on legs and abdomen, the absence of macrosetae on the postpronotal lobe and the presence of strong, short, yellowish marginal macrosetae on the abdominal tergites.

Distribution, biodiversity hotspots, endemism, seasonal imago flight activity and biology. A widespread and commonly collected species occurring primarily in western and southern South Africa (see Londt (2010): fig. 65). Within the southern Namib Desert, only known from five collecting events in the southernmost part in the transition zone to the Succulent Karoo (Table 2, Fig. 11A). The species is known to occur in the Cape Floristic Region, Succulent Karoo and Maputaland-Pondoland-Albany biodiversity hotspots (see Londt (2010): fig. 65), but also occurs outside of these hotspots. Notably, the specimens collected around Lüderitz in the south-western region of the southern Namib Desert (Fig. 11A) oc-

Figure 4. Habitat photographs where *Acnephalomyia* specimens were observed and collected. **A.** Small dune off dry Kuiseb riverbed, Gobabeb, Namib-Naukluft NP, Erongo, Namibia (23°34'01"S, 015°02'56"E), *A. eremia* collected, 23 Sep 2019; **B.** Small dune with !nara plant (Cucurbitaceae, *Acanthosicyos horridus*), Gobabeb, Namib-Naukluft NP, Erongo, Namibia, *A. eremia* collected, 27 Sep 2017; **C.** High dune with *Stipagrostis sabulicola* (Poaceae), Kahani Dunes, Namib-Naukluft NP, Hardab, Namibia (23°36'14"S, 015°00'40"E), *A. eremia* collected, 25 Sep 2019; **D.** Hope Mine Wash, Namib-Naukluft NP, Erongo, Namibia (23°34'05"S, 015°16'39"E), *A. metallicoindica* sp. nov. collected, 24 Sep 2019; **E.** Ganab, Namib-Naukluft NP, Erongo, Namibia (23°05'46"S, 015°31'04"E), *A. metallicoindica* sp. nov. collected, 22 Oct 2024; **F.** gravel plains from top of Vogelfederberg (looking East), Namib-Naukluft NP, Erongo, Namibia (approx. 23°03'32"S, 014°59'30"E), locality for *A. metallicoindica* sp. nov., photo 4 Feb 2012. Photographs by T. Dikow.

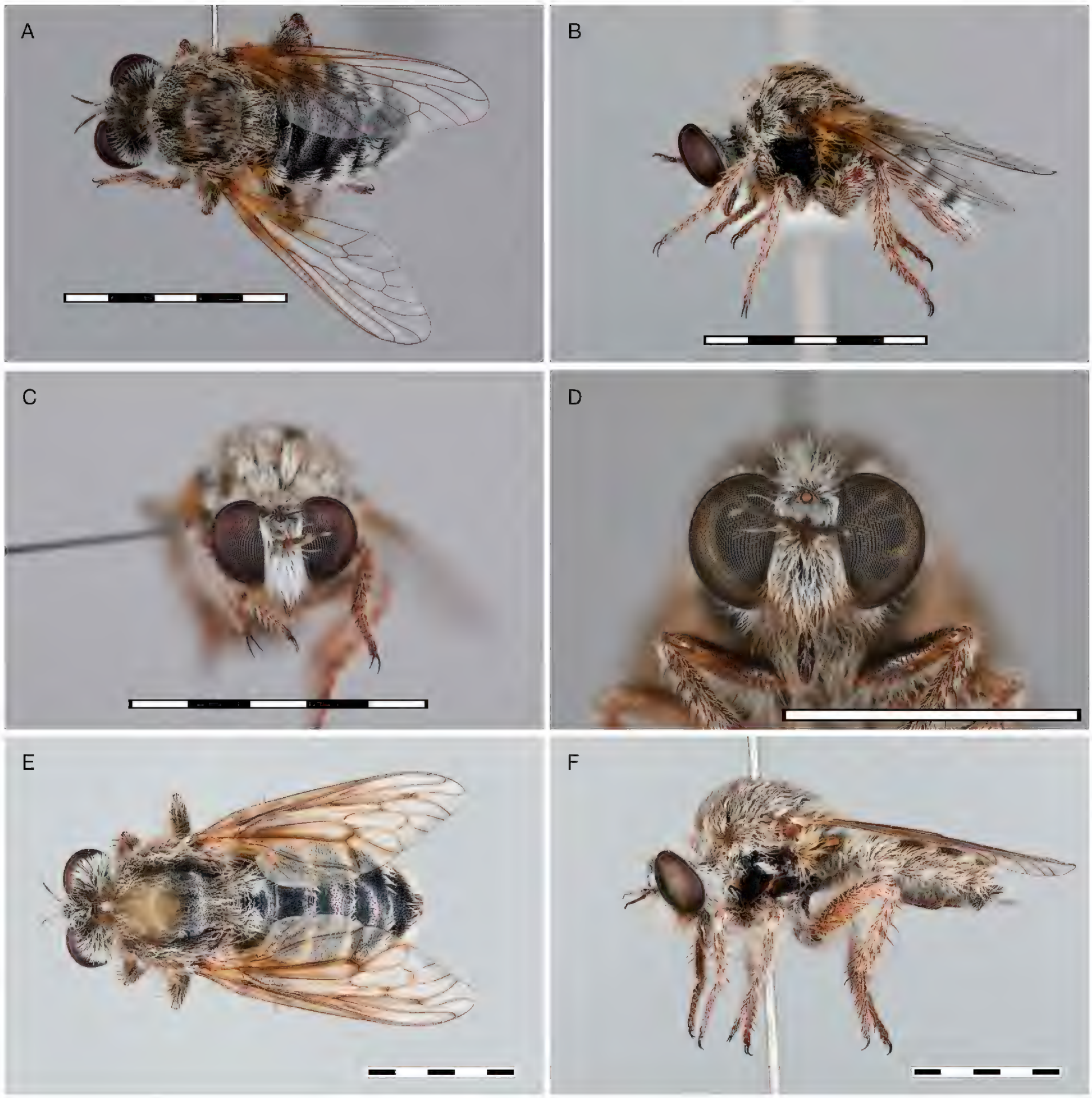

Figure 5. *Acnephalomyia andrenoides*. **A.** ♂ (USNMENT00870066, images at FigShare doi: https://doi.org/10.25573/data.30142297), dorsal; **B.** Same, lateral; **C.** Same, head anterior; **D.** ♀ (USNMENT00870068, FigShare https://doi.org/10.25573/data.30142300), head anterior; **E.** Same, dorsal; **F.** Same, lateral. Scale bar: 5 mm. Both specimens collected outside study area (South Africa – Western Cape • 1♀1♂ S Papendorp; 31°43'01"S, 018°12'22"E; 9 m a.s.l.; 29 Sep. 2009; Dikow, Torsten, Londt, Jason leg.; vegetated dunes + margin; USNM).

cur within the boundaries of the Succulent Karoo biodiversity hotspot. The species is not endemic to a particular environment or country. Adult flies are active in spring (August–September) in the southern Namib Desert (Table 3). Londt (2010) lists the following prey records, none of which originates from specimens in the southern Namib Desert for the species: Coleoptera, Buprestidae, Coccinellidae, Dermestidae, Melyridae, Scarabaeidae; Diptera, Muscidae; Hemiptera, Lygaeidae, Pentatomidae; Isoptera, Hodotermitidae; Orthoptera, Tridactylidae.

***Acnephalomyia eremia* Londt, 2010**
Figs 3B–D, 6, 11B

Links.
ZooBank https://zoobank.org/59C30BB4-227C-4B1D-AC4B-9B157DEB1824.
GBIF https://www.gbif.org/species/8978948.
Plazi TreatmentBank https://treatment.plazi.org/id/FA455017-FFF0-AD6E-FE29-74BA4E61FDA4.
iNaturalist https://www.inaturalist.org/taxa/1567030-Acnephalomyia-eremia.

Type locality. Namibia: Erongo: The Far East, 15 km NW (23°39'38"S, 015°40'46"E, updated more precise coordinates).

Material examined. *Holotype*. Namibia – Erongo • 1♂ The Far East, 15 km NW; [23°39'38"S, 015°40'46"E]; 08 Aug 1982; Praetorius, Leon leg.; dune, NMSA-DIP 073854; NMSA.

Other material. Namibia – Erongo • 1♀ Namib-Naukluft National Park, Gobabeb 20 km NW on D1983, Kuiseb riverbed; 23°24'31"S, 014°54'13"E; 320 m a.s.l.; 21 Oct. 2024; collected p.m. (15:00–18:00); Cabrero, Allan, Dikow, Torsten leg.; margin of dry riverbed, perching on sand, USNMENT02018210; NMNW • 1♀ 1♂ Namib-Naukluft National Park, Gobabeb, small dunes S of station; 23°34'01"S, 015°02'56"E; 403 m a.s.l.; 23 Sep 2019; collected a.m. (9:00–noon); Dikow, Torsten, Cabrero, Allan leg.; small dunes, perching on sand, USNMENT01519438, USNMENT01519439; USNM • 1♀ Namib-Naukluft National Park, Gobabeb, small dunes W of Kuiseb River; 23°33'50"S, 015°01'59"E; 398 m a.s.l.; 25 Sep 2019; collected p.m. (15:00–18:00); Dikow, Torsten, Cabrero, Allan leg.; perching on sand, USNMENT01519486; USNM • 5♀ 2♂ Namib-Skeleton Coast National Park, Gobabeb; 23°33'52"S, 015°02'07"E; 398 m a.s.l.; 27 Sep 2017; collected a.m. (9:00–noon); Dikow, Torsten leg.; small vegetated dunes, perching on sand, USNMENT01384004, USNMENT01384050, USNMENT01384095, USNMENT01384110, USNMENT01384120, USNMENT01396557, USNMENT01456200; USNM • 5♀ 4♂ Namib-Skeleton Coast National Park, Gobabeb, dunes W of Kuiseb riverbed; 23°33'48"S, 015°01'58"E; 401 m a.s.l.; 28 Sep 2017; collected a.m. (9:00–noon); Dikow, Torsten leg.; partly vegetated dune, perching on sand, USNMENT01384036, USNMENT01384062, USNMENT01384094, USNMENT01384932, USNMENT01384933, USNMENT01384934, USNMENT01406050, USNMENT01406052, USNMENT01406054; USNM.

Namibia – Hardap • 2♀ Namib-Naukluft National Park, Gobabeb, Kahani dunes; 23°36'14"S, 015°00'40"E; 474 m a.s.l.; 25 Sep 2019; collected p.m. (15:00–18:00); Dikow, Torsten, Cabrero, Allan leg.; base of high dune with *Stipagrostis* hammocks, perching horizontally on low vegetation, USNMENT01519464, USNMENT01519475; USNM • 1♀ Namib-Naukluft National Park, Gobabeb, Kahani dunes; 23°36'20"S, 015°00'46"E; 452 m a.s.l.; 23 Oct 2024; collected a.m. (9:00–noon); Cabrero, Allan, Dikow, Torsten leg.; high dune, E facing side, perching on sand, USNMENT02018419; NMNW.

Namibia – Karas • 1♂ Sylvia Hill, 15 km NE; [25°03'31"S, 014°57'52"E]; 15–16 Sep 1971; NMNW-H4120; NMNW.

Diagnosis. The species is distinguished from congeners by the overall white setation (especially males, females with some yellowish setae on thorax), the presence of white setation on the postero-dorsal katepisternum, the presence

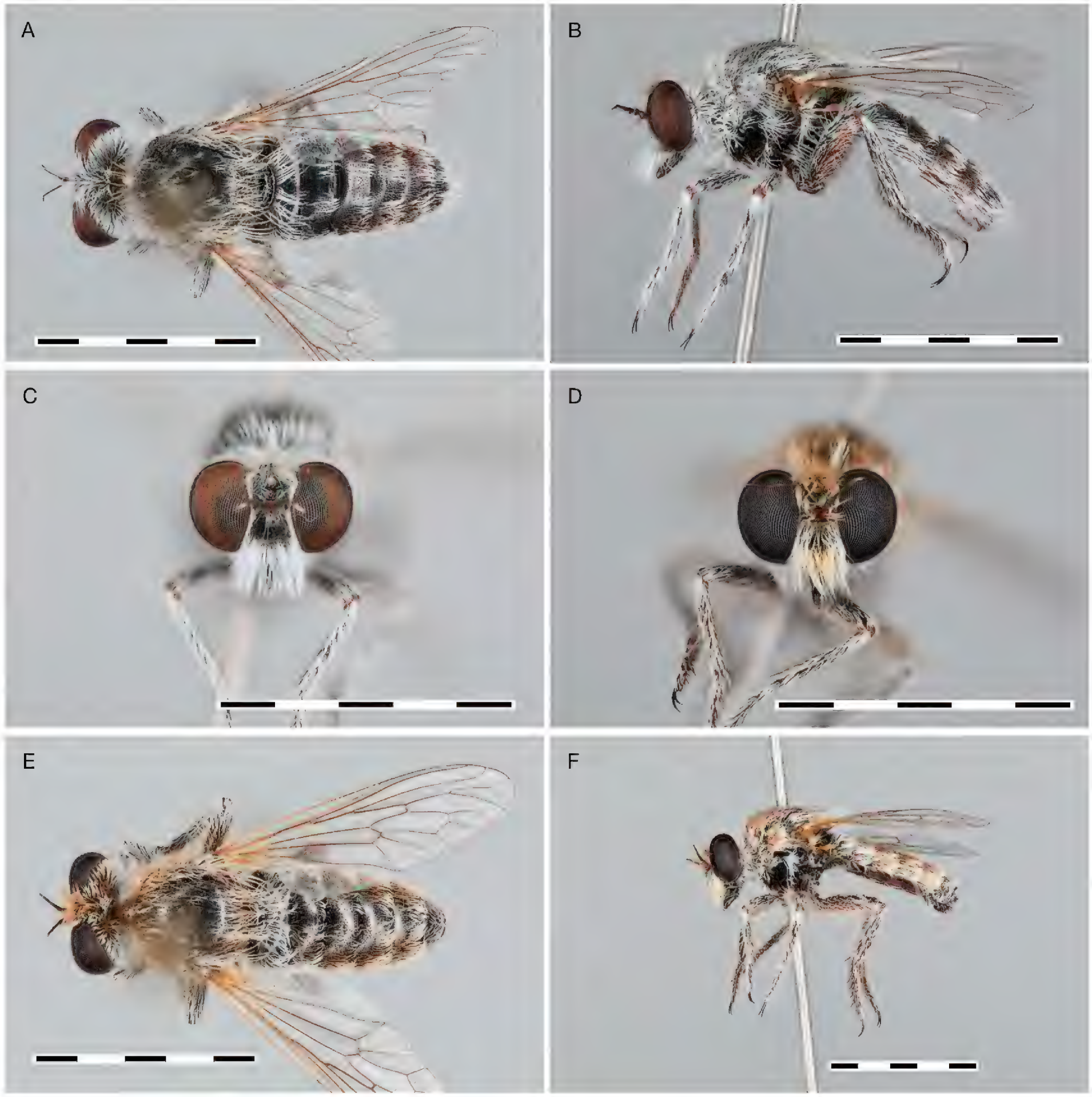

Figure 6. *Acnephalomyia eremia*. **A.** ♂ (USNMENT01519438, images at FigShare https://doi.org/10.25573/data.30142306), dorsal; **B.** Same, lateral; **C.** Same, head anterior; **D.** ♀ (USNMENT01519439, FigShare https://doi.org/10.25573/data.30142321), head anterior; **E.** Same, dorsal; **F.** Same, lateral. Scale bar: 5 mm.

of macrosetae on the postpronotal lobe, the entirely hyaline wings and the restricted distribution in the Namib Sand Sea of the Namib Desert.

Distribution, biodiversity hotspots, endemism, seasonal imago flight activity and biology. Known from eight localities, several of them near each other, associated with sand dunes in the northern part of the southern Namib Desert, with one locality in the central-western area (Fig. 11B). A somewhat rarely collected species known from 25 specimens of which the majority was collected since 2017 (Table 2). The species is not known to occur in any currently recognised biodiversity hotspot, but is endemic to the Namib Desert and likely the Namib Sand Sea in particular. Adult flies are active in spring (August to October) (Table 3). Nothing is known of the biology.

***Acnephalomyia metallicoindica* sp. nov**

https://zoobank.org/20E0B09A-57FD-473F-BA78-42ED3ECEDB37

Figs 7, 8, 11A

Type locality. Namibia: Erongo: Namib-Naukluft National Park, Hope Mine wash (23°34'05"S, 015°16'39"E).

Description. ***Head*:** wider than high, black; vertex slightly depressed (less than 60° angle on median margin of compound eye); facial swelling indistinct, but extending over entire face, whitish-silver pubescent; mystax yellowish-white macrosetose ventrally and para-medially, long white setose laterally (no setae medially), extending over lower ¾ of face, long, reaching beyond tip of proboscis; ommatidia of different size, at least some median ommatidia distinctly larger; postgena posterior margin simple, smooth; frons (at level of antennal insertion) more or less parallel-sided, whitish-silver pubescent, laterally asetose; ocellar tubercle apubescent, white setose; vertex apubescent, predominantly asetose, yellowish-white macrosetose at base of ocellar tubercle; median occipital sclerite (m ocp scl) asetose; postocular (pocl) setae straight, yellowish macrosetae; occiput lightly grey pubescent, predominantly asetose, ventrally long white setose; compound eye posterior margin (in lateral view) straight or slightly curved throughout.

***Proboscis and maxillary palpus*:** proboscis straight, black; postmentum plate-like, straight, median groove only in distal part, white setose ventrally; prementum circular, with dorso-median flange, asetose; labella reduced, fused to prementum entirely, occupying from 1/3 to 1/2 length of proboscis, apically rounded, yellowish setose; maxillary palpus dark brown, one-segmented, long white setose distally, cylindrical; stipites fused entirely medially, apubescent, long white setose, laterally with 2 white macrosetae.

***Antenna*:** dark brown, lightly grey pubescent; scape dark brown, apubescent, approximately as long as pedicel, 3 yellowish macrosetae ventrally, long, reaching at least centre of postpedicel; pedicel dark brown, lightly grey pubescent, long yellowish macrosetose ventrally, shorter white setose dorsally; postpedicel cylindrical (same diameter throughout), 1.5x as long as scape and pedicel combined, brown to dark brown, lightly grey pubescent, asetose; stylus comprised of 2 elements, element 1 dark brown, element 2 dark brown, stylus 0.3x as long as postpedicel, asetose; apical seta-like sensory element situated apically in cavity on stylus, hyaline.

***Thorax*:** black, bluish metallic; prosternum grey pubescent, separated from pro-episternum, square to rectangular in shape (straight dorsally); pro-episternum grey pubescent, long white setose; cervical sclerite long yellowish-white setose; antepronotum grey pubescent, short yellowish setose and long yellowish macrosetose; postpronotum predominantly apubescent, grey pubescent anteriorly and laterally, short yellowish-white setose, long yellowish-white macrosetose laterally; postpronotal lobe grey pubescent, short white setose, 1–3 long yellowish-white macrosetae; pleuron predominantly apubescent, greyish-silver pubescent anteriorly and dorsally; pro-epimeron grey pubescent, long white setose anteriorly; anepisternum grey pubescent anteriorly and dorsally, apubescent otherwise, short white setose dorsally, single long yellow macroseta postero-medially, supero-posteriorly asetose; anterior basalare asetose, posterior basalare asetose; anepimeron ante-

Figure 7. *Acnephalomyia metallicoindica* sp. nov. **A.** ♂ (paratype, USNMENT01519447, images at FigShare https://doi.org/10.25573/data.30148642), dorsal; **B.** Same, lateral; **C.** Same, head anterior; **D.** ♀ (paratype, USNMENT01519446, FigShare https://doi.org/10.25573/data.30148558), head anterior; **E.** Same, dorsal; **F.** Same, lateral. Scale bars: 5 mm.

ro-dorsally grey pubescent, asetose; katepisternum apubescent, asetose; katepimeron apubescent, asetose; katatergite yellowish-grey pubescent, long yellowish macrosetose; meron + metanepisternum predominantly apubescent, yellowish-grey pubescent posteriorly, asetose; metakatepisternum grey pubescent, asetose; metepimeron yellowish-grey pubescent, apubescent ventrally, asetose; anatergite white pubescent, asetose; scutum whitish-grey pubescent, apubescent stripes paramedially (not reaching scutellum), apubescent areas pre- and postsuturally laterally, scutum setation: sparsely white setose only in pubescent areas, setae with small sockets, 2 yellowish npl setae, 2–3 yellowish spa setae, 1 yellow pal setae, dc setae

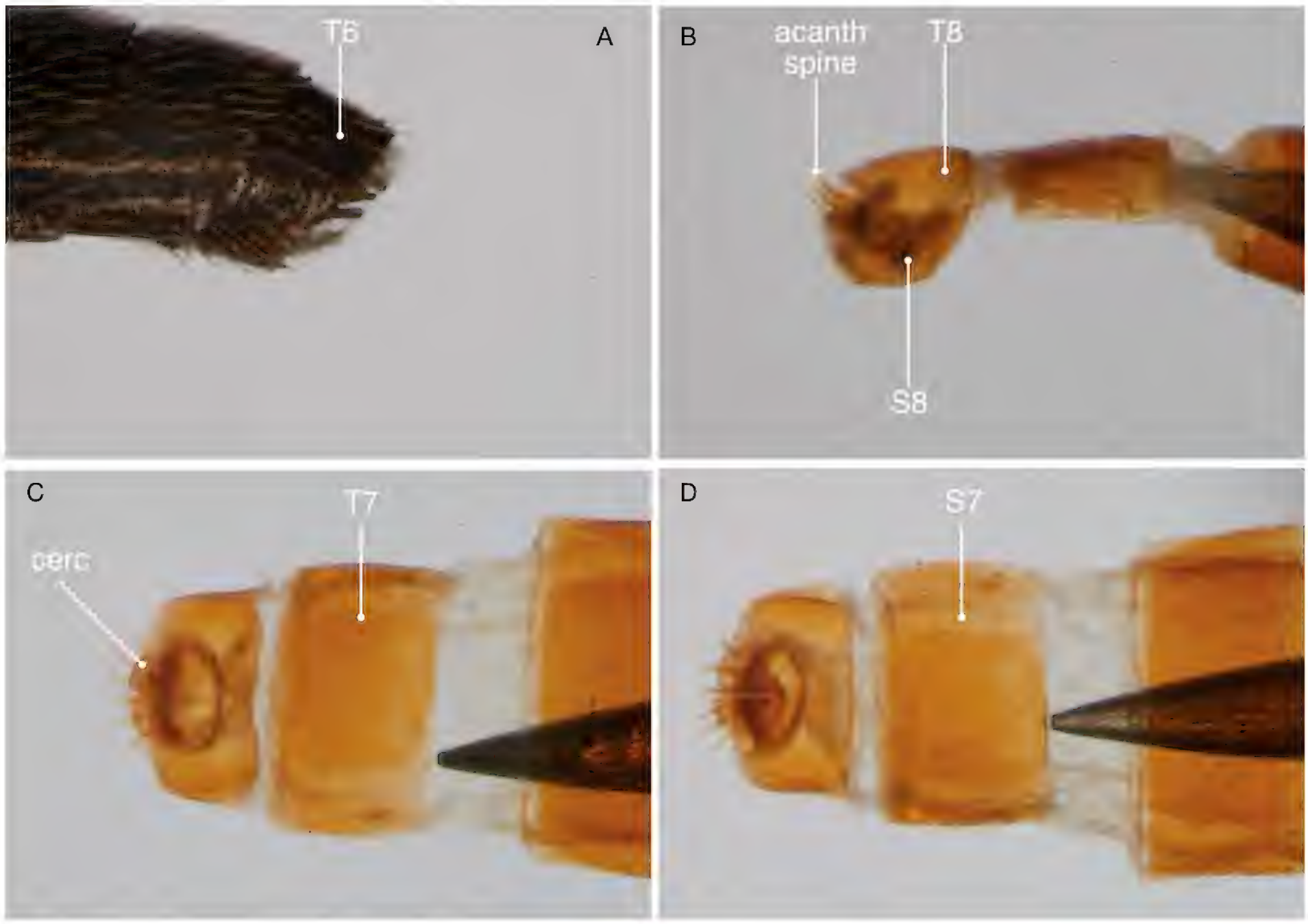

Figure 8. *Acnephalomyia metallicoindica* sp. nov. terminalia. **A.** ♂ (paratype, USNMENT01519447, images at FigShare https://doi.org/10.25573/data.30148642), lateral; **B.** ♀ (paratype, USNMENT01519440, FigShare https://doi.org/10.25573/data.30148657), lateral; **C.** Same, dorsal; **D.** Same, ventral. Magnification = 100x, cerc = cerci, acanth spine = acanthophorite spine.

long white pre- and postsuturally, macrosetae absent, acr setae few long white presuturally, median posterior scutum (between dc setae) sparse long white setose, setae directed posteriorly; scutellum apubescent, ds sctl setae absent, ap sctl setae present, 7–8 long yellow macrosetae; postmetacoxal area entirely membranous.

***Leg*:** black, apubescent, all setae circular in cross section; pro coxa black, greyish-silver pubescent, white setose and yellowish macrosetose; pro trochanter black, apubescent, white setose; pro femur black, short brown setose, longer white setose ventrally, 1 yellowish macroseta postero-distally; pro tibia black, short white setose, yellowish macrosetose: 4 in 1 antero-dorsal row, 3 in 1 dorsal row, 5 in 1 posterior row, 3 in 1 postero-ventral row, distal tip with 3–4 long yellowish and 2 long brown macrosetae; mes coxa black, greyish-silver pubescent, yellowish macrosetose; mes trochanter dark brown, apubescent, short white setose; mes femur black, short brown setose, longer white setose ventrally, yellowish macrosetose: 1 antero-distally, 1 dorso-distally, 1 postero-distally; mes tibia black, short white setose, yellowish macrosetose: 4 in 1 anterior row, 4 in 1 dorsal row, 4 in 1 antero-ventral row, 3 in 1 postero-ventral row, distal tip with 2 long yellowish and 4 long brown macrosetae; met coxa black, grey pubescent, white setose, 1 long yellowish macroseta laterally, anteriorly without any protuberance; met trochanter black, apubescent,

white setose, 1 yellowish macroseta, cylindrical, medially without any protuberance; met femur black, short white setose, longer yellowish setose ventrally, yellowish macrosetose: 3–4 in 1 anterior row, 2 dorso-distally; met tibia black, straight, short white setose, yellowish macrosetose: 3 in 1 anterior row, 4 in 1 antero-ventral row, 4 in 1 dorsal row, distal tip with 5 long dark brown and 1 long yellowish macrosetae; proximal pro and mes tarsomere as long as following 2 tarsomeres combined, proximal met tarsomere longer than 2 following tarsomeres combined, proximal met tarsomere as wide as following tarsomeres; pro tarsomeres 1–5 short brown setose, tarsomeres 1–4 long dark-brown macrosetose laterally and dorso-laterally; mes tarsomeres 1–5 short brown setose, tarsomeres 1–4 long dark-brown macrosetose laterally and dorso-laterally; met tarsomeres 1–5 short brown setose, tarsomeres 1–4 long dark-brown macrosetose laterally and dorso-laterally; pulvilli small, 1/3 length of claw; claw fairly straight throughout, pointed; empodium setiform, approximately 1/2 length of claw.

***Wing*:** 3.8–4.2 mm, hyaline, without microtrichia; C terminating at CuA and CuP, anterior wing margin in males straight; R_{2+3} distally relatively straight, r_1 open; R_4 terminating anterior to wing apex, relatively straight, stump vein (R_3) absent; r_4 open, R_4 and R_5 diverging from each other; R_5 terminating posterior to wing apex; r_5 open; M_1 terminating posterior to wing apex; cell d closed by base of M_2 and m–m, M_2 and m–m not aligned, r–m situated in distal half; m_3 open; cu*a* closed at C (non-petiolate); alula well-developed; microtrichia on posterior wing margin arranged in a single plane.

***Abdomen*:** shape compressed, T2–3 distinctly transversely rectangular (length to width ratio > 1:3), dark brown to black (bluish metallic touch), tergites smooth, setae with small sockets only; T1 sparsely short white setose medially, laterally long yellowish setose, 4–5 long yellow macrosetae postero-laterally, apubescent, entirely sclerotised medially, dorsal surface smooth, without protuberances; T2–8 entirely sclerotised, black to dark brown (bluish metallic touch), segments laterally and posteriorly narrowly brown, apubescent, sparsely short white setose, longer white setose antero-laterally on T2, marginal macrosetae absent on T2–7, medial macrosetae absent on T2–7; S1–8 black to dark brown, lightly grey pubescent anteriorly, sparsely short white setose.

Female (Fig. 8B–D): T7 and S7 without modifications, ovipositor comprised of 8th and following segments, T6–8 apubescent, setation directed dorsally; postero-paramedian T8 pores absent; T8 with internal rectangular apodeme (entirely fused to T) anteriorly, S8 plate-like, slightly emarginate medio-distally; T9 and T10 partly fused, T10 divided into 2 heavily sclerotised acanthophorite plates, with 5 dark brown acanthophorite spines per plate; cerci simple and flat, long yellowish setose; 3 spermathecae, all equally large, reaching posterior end of segment 6; common spermathecal duct short, not extending beyond tip of genital fork (S9, furca), individual spermathecal ducts short; ejection apparatus not observable; spermathecal reservoirs formed by more or less expanded ducts, weakly sclerotised; genital fork (S9, furca) formed by single, inverted V-shaped sclerite, median sclerite (at posterior tip) absent, anterior apodeme absent.

Male (Fig. 8A): T1–T8 entire, S1–S2 reduced, S3–S7 entire, S8 reduced or lost; hypopygium dark brown, not rotated, directed posteriorly; epandrium divided medially into 2 halves, joined proximally; hypandrium well-developed, trian-

gular, posterior margin with long postero-median projection, distinctly separated from epandrium by gonocoxite, not fused to gonocoxite; gonocoxite entirely free from epandrium; gonostylus present, positioned distally on gonocoxite; subepandrial sclerite asetose, ventrally smooth (without protuberances), laterally straight (without protuberances), distal margin simple, straight margin; cerci fused medially; phallus long, tip at tip of gonocoxite and gonostyli, 1 phallic prong, tip pointed, without any protuberance.

Material examined. ***Holotype*.** Namibia – Erongo • 1♀ Namib-Naukluft National Park, Hope Mine wash; 23°34'05"S, 015°16'39"E; 589 m a.s.l.; 24 Sep 2019; collected a.m. (9:00–noon); Dikow, Torsten, Cabrero, Allan leg.; dry, open wash, perching on sand, USNMENT01519441; NMNW.

***Paratypes*.** Namibia – Erongo • 4♀ 1♂ Namib-Naukluft National Park, Hope Mine wash; 23°34'05"S, 015°16'39"E; 589 m a.s.l.; 24 Sep 2019; collected a.m. (9:00–noon); Dikow, Torsten, Cabrero, Allan leg.; dry, open wash, perching on sand, USNMENT01519440, USNMENT01519442, USNMENT01519443, USNMENT01519446, USNMENT01519447, Paratype; USNM • 1♀ near Vogelfederberg; [23°03'17"S, 014°59'21"E]; 13 Nov 1986; Kleinjan, C. leg.; gravel plains, NMSA-DIP 007177, Paratype *Acnephalomyia iota* Londt, 2010; NMSA • 1♀ Namib-Naukluft National Park, Ganab; 23°05'46"S, 015°31'04"E; 971 m a.s.l.; 22 Oct 2024; collected a.m. (9:00–noon); Dikow, Torsten, Cabrero, Allan leg.; gravel plains with adjacent wash, perching on ground, USNMENT02018420, Paratype; NMNW.

Diagnosis. The species is distinguished from congeners by the predominantly apubescent thorax and abdomen, the metallic bluish-black cuticle, the absence of dorso-ventrally flattened setae on legs and abdomen, the small size (wing length 3.8–4.2 mm) and the restricted distribution on the gravel plains of the Namib Desert. From *Acnephalomyia iota* in particular, it is distinguished by the few, thin setae on pubescent stripes on the scutum (*A. iota* entire scutum covered with short setae) and the absence of stump vein R_3 at base of R_4 (*A. iota* with short stump vein).

Etymology. Latin *metallicus* = metallic, *indicum* = indigo. The specific epithet, treated as feminine, refers to the metallic blue colour of this species.

Distribution, biodiversity hotspots, endemism, seasonal imago flight activity and biology. Known only from three localities on or near the Namib Desert gravel plains in the northern parts of the southern Namib Desert (Fig. 11A). A rarely collected species known only from eight specimens from three collecting events (Table 2). The species is not known to occur in any currently recognised biodiversity hotspot, but is endemic to the Namib Desert and likely the gravel plains in particular. Adult flies are active in spring (September and October) (Table 3). Nothing is known of the biology.

Remarks. When the newly-collected specimens of *A. metallicoindica* sp. nov. were compared to photographs of the holotype of *A. iota*, kindly provided by Kirstin Williams (NMSA), it was discovered that they belong to an undescribed species and that the paratype female of *A. iota* from near Vogelfederberg (Fig. 11A) also belongs to this new Namib species. *A. iota* was described, based on three specimens – two males from near Nieuwouldtville and Brandkop in the Northern Cape Province of South Africa and the female from near Vogelfederberg in Namibia. The two Northern Cape localities are only 5 km apart, whereas the distance to the Vogelfederberg is approxi-

mately 1,000 km. Londt (2010) mentioned several features distinguishing this female from the two males. However, because of the possibility of sexual dimorphism within *A. iota*, Londt refrained from describing two distinct species. We can provide evidence (see diagnosis) that there is no sexual dimorphism in *A. metallicoindica* sp. nov. and that the Namib Desert species is distinct from *A. iota*, which is now restricted to a small area in the central Northern Cape Province. The known collecting localities of *A. metallicoindica* sp. nov. on the Namib Desert gravel plains (Fig. 4D–F) are also quite distinct from Fynbos vegetation north-east of Nieuwouldtville, South Africa. Amongst the eight known specimens of *A. metallicoindica* sp. nov. is only a single male specimen. We refrained from dissecting the male terminalia to preserve the integrity of this unique specimen, but provide a high-magnification photo of the lateral aspect of the tip of the abdomen (Fig. 8A) even though these are retracted significantly under tergite 6 in *Acnephalomyia*.

***Acnephalomyia platygaster* (Loew, 1858)**
Figs 9, 10, 11B

Links. ZooBank https://zoobank.org/3B30C903-65C3-4305-9FBB-D5389298A469. GBIF https://www.gbif.org/species/12026579.
original description online https://www.biodiversitylibrary.org/page/15959408. Plazi TreatmentBank https://treatment.plazi.org/id/FA455017-FFFC-AD61-FEBC-7445490FFDA0.

Type locality. Namibia: Erongo: Swakop (= Swakop riverbed) (22°41'09"S, 014°31'51"E, updated more precise coordinates).

Material examined. *Holotype*. Namibia – Erongo • 1♂ Swakop (= Swakop riverbed); [22°41'09"S, 014°31'51"E]; 1854; Wahlberg, J. leg.; NHRS-GU-LI-000111153; NHRS.

Other material. Namibia – Karas • 1♀ Aus, outskirts overlooking town; [26°39'57"S, 016°15'34"E]; 30 Aug 1983; Stuckenberg, Brian, Londt, Jason leg.; rocky area, shrubs; NMSA-DIP 108897; NMSA.

Diagnosis. The species is distinguished from congeners by the yellowish to light brown setose scutum, the postero-dorsally white setose katepisternum, the presence of dorso-ventrally flattened setae on legs and abdomen, the strong, light brown macrosetae on the postpronotal lobe and the presence of strong, short, yellowish marginal macrosetae on the abdominal tergites.

Distribution, biodiversity hotspots, endemism, seasonal imago flight activity and biology. A widespread but less commonly collected species occurring from Swakopmund in Namibia in the north to southern South Africa (see Londt (2010): fig. 67) with the majority of records from southern Namibia (Karas Region) and north-western South Africa (Northern Cape Province). A rarely collected species in the southern Namib Desert known only from two specimens from two collecting events (Table 2). The species is known to occur in the Cape Floristic Region and Succulent Karoo biodiversity hotspots (see Londt (2010): fig. 67), but also occurs outside of these hotspots. The species is not endemic to a particular environment or country. Adult flies are active in spring (August) in the southern Namib Desert (Table 3). Nothing is known of the biology.

Figure 9. *Acnephalomyia platygaster*. **A.** ♂ holotype (NHRS-GULI-000111153), dorsal; **B.** Same, lateral; **C.** Same, head anterior. Scale bar: 10 mm. Photographs by NHRS staff.

Remarks. The exact locality and collection details of the holotype are unknown, but Brinck (1955, p. 31) provides an overview of J.A. Wahlberg's collecting in the Swakop riverbed in May 1854 and July–October 1854. All *Acnephalomyia* specimens from the southern Namib Desert have been collected in the spring only (see Table 2) so it seems more plausible that the holotype was collected between August and October 1854. From that, it is also apparent that the species was collected in the western Namib as Wahlberg used Rooibank (27 km SE of Walvis Bay on the coast, Fig. 1) as his base (and the species is not a more inland species in the Swakop riverbed between Swakopmund and Otjimbingwe, which Wahlberg travelled in May 1854).

Londt (2010) cites a specimen from Gobabeb belonging to *Acnephalomyia platygaster*. The study of this specimen deposited in the South African National Collection of Insects (SANC, Namibia – Erongo • 1♀ Gobabeb; 23°33'37"S, 015°02'26"E; Feb 1984; Marsh, B. leg.; feeding on flowers of female *Welwitschia*) revealed that it belongs to the genus *Sisyrnodytes* and can, at present, not be identified further (see Londt (2009), interestingly this specimen together with another one in the NMNW are the only known specimens of *Sisyrnodytes* from Gobabeb to date). This specimen was originally identified as *Acnephalum platygaster* by Jason Londt in 1984 and subsequently received another ID label as *Acnephalomyia platygaster* by Londt in 2009. The holotype of *A. platygaster* is, therefore, the northernmost record for this species and no other specimens have been collected in and around Swakopmund/Swakop riverbed/Walvis Bay since 1854.

Figure 10. *Acnephalomyia platygaster*. **A.** ♂ (NMSA-DIP 108887, images at FigShare https://doi.org/10.25573/data.30142279), dorsal; **B.** Same, lateral; **C.** Same, head anterior; **D.** ♀ (NMSA-DIP 108898, FigShare https://doi.org/10.25573/data.30142294), head anterior; **E.** Same, dorsal; **F.** Same, lateral. Scale bars: 5 mm. Both specimens collected outside study area (Namibia – Karas • 1♀1♂ Karasburg, 50 km NW, in Karasberg mountains; [27°36'29"S, 018°40'29"E]; 28 Aug.; 1983; Londt, Jason, Stuckenberg, Brian leg.; NMSA).

Key to species of *Acnephalomyia* in Namibia and the southern Namib Desert

An online, illustrated version of the below dichotomous pathway key is available at https://keys.lucidcentral.org/keys/v4/acnephalomyia_namib_dichotomous/.

1 Katepisternum entirely asetose (Fig. 5B, F); postpronotal lobe setose only, not macrosetose **3**

– Katepisternum postero-dorsally white setose (Fig. 6B, F); postpronotal lobe setose and macrosetose **2**

2 Wing entirely hyaline (Fig. 6A, E); abdominal tergite 2 laterally with either 1 or 2 strong macrosetae or only regular white setae..... ***Acnephalomyia eremia***

– Wing brown stained in (at least) proximal 1/2 (Figs 9A, 10A, E); abdominal tergite 2 laterally with 6–7 strong, short, yellowish marginal macrosetae (in addition to white to yellowish setae) ..... ***Acnephalomyia platygaster***

3 Scutum predominantly asetose (Fig. 7A, E) with only few long white acrostichal and dorsocentral setae on pubescent stripes; tibia with only few appressed, regular white setae (in addition to erect macrosetae) (Fig. 7B, F) ..... ***Acnephalomyia metallicoindica* sp. nov.**

– Scutum setose, covered by long white, yellowish or light brown setae (Fig. 5A, E); tibia covered by appressed, dorso-ventrally flattened white setae (in addition to erect macrosetae and setae) (Fig. 5B, F) ..... ***Acnephalomyia andrenoides***

Discussion

Distribution

Species of *Acnephalomyia* are only known from western South Africa and the southern half of Namibia to date. Within the southern Namib Desert, species have so far only been recorded from the southern parts close to the Succulent Karoo and the northern part (Figs 2B, 11, but see Conclusion). *Acnephalomyia platygaster* is the rarest of the *Acnephalomyia* species within the southern Namib Desert and has not been collected near Swakopmund/Swakop riverbed/Walvis Bay, relatively well-sampled areas due to the easy access, since 1854.

Seasonal imago flight activity

The species of *Acnephalomyia* in the southern Namib Desert have been collected in the Southern Hemisphere late winter to spring – August–October – with a single record in November (Table 3). With the exception of the *A. eremia* record for August, all other records for August are from the southern parts of the Namib Desert close to the Succulent Karoo winter rainfall region. In addition, Londt (2010) recorded *A. andrenoides* and *A. platygaster* with numerous records in the Succulent Karoo in southern Namibia (south of the B4 road from Aus–Lüderitz) collected in August.

Conclusion

Of the now eight *Acnephalomyia* species, four occur within the southern Namib Desert. Two of these species, *A. eremia* and *A. metallicoindica* sp. nov., are endemic to this desert and associated with sand dunes of the Namib Sand Sea and the gravel plains, respectively.

The southern Namib Desert is an accessible study area with the centrally located Gobabeb Namib Research Institute at its heart and a gravel road network throughout it, except for the inaccessible Namib Sand Sea. This region includes tourist attractions such as Swakopmund and Sossusvlei and an incredible diversity of plants and insects. This article is the first in a series focusing on the asiloid flies of the southern Namib Desert and, while only a single new species is described herein, the distribution of *A. eremia* has been extended significantly. The

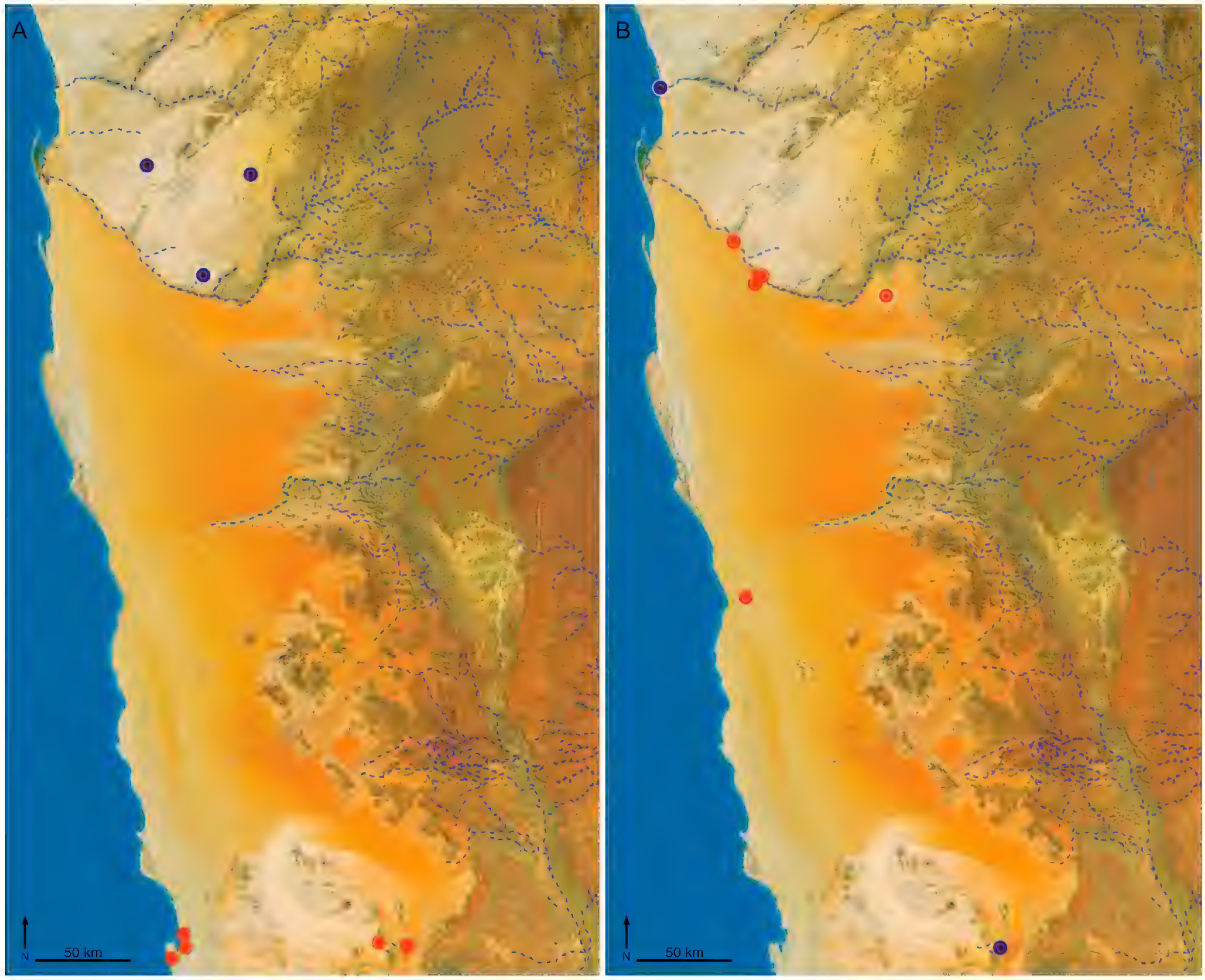

Figure 11. Distribution of *Acnephalomyia* species in the southern Namib Desert. **A.** *Acnephalomyia andrenoides*, red circles, *A. metallicoindica* sp. nov., purple circles; **B.** *A. eremia*, red circles, *A. platygaster*, purple circles. White outline = type locality. Occurrence data available at GBIF (dataset https://www.gbif.org/dataset/aef90774-efd0-4629-80ce-85bc-4cbe24e8, DOI 10.15468/2bbawn).

species was described from a single specimen by Jason Londt in 2010 and so far is still only known from a few collecting events near the Gobabeb Namib Research Institute, but also from the isolated Sylvia Hill in the western Namib Sand Sea close to the Atlantic Ocean (Figs 2B, 11B). One has to recognise though that this species will likely occur in much of the Namib Sand Sea. Likewise, *A. metallicoindica* sp. nov. is likely active throughout much of the Namib gravel plains in the northern section of the study area even though only three collecting events are known today.

Swakopmund, where the holotype of *Acnephalomyia platygaster* was collected, is so far the northern-most record for the genus *Acnephalomyia*. When this manuscript was in peer review, the 3rd author located specimens of *Acnephalomyia* from the Brandberg – the highest mountain of Namibia, located in the Namib Desert and with an incredible diversity of Diptera (see Kirk-Spriggs and Marais (2000)) – amongst material from the NMNW on loan to Jason Londt at the NMSA. The mountain massif is approx. 170 km north of Swakopmund. It is not known why Jason Londt did not include these specimens in his revision of *Acnephalomyia* (Londt 2010), even though the specimens were at the NMSA at that time. The Brandberg

falls outside of the study area delimited above and therefore, these specimens are not included in this review and need attention in a future study.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Use of AI

AI was not used in any part of this research project.

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Author contributions

TB Photographed specimens, co-developed species hypothesis, conducted specimen study, entered species description, verified specimen data capture, co-wrote and reviewed manuscript. AC Conducted field work, co-developed species hypothesis, co-mentored undergraduate trainee TB, co-wrote and reviewed manuscript. TD Designed

study, verified specimen study and data capture, co-developed species hypothesis, co-mentored undergraduate trainee TB, wrote majority of manuscript.

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Data availability

All of the data that support the findings of this study are available in the main text.

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